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(12) United States Patent  
Naji et al.

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(45) Date of Patent: Dec. 18, 2001

(54) MTI MBAM SERIES-PARALLEL ARCHITECTURE

(55) Inventors: Peter K. Naji, Phoenix, Mark DeHerrera, Tempe, Mark Durkin, Chandler, all of AZ (US)

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(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: 08/648,317  
(22) Filed: Aug. 28, 2000

(51) Int. Cl. G11C 11/00  
(52) U.S. Cl. 365/188, 365/171  
(58) Field of Search 365/158, 171, 365/173

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(37) ABSTRACT

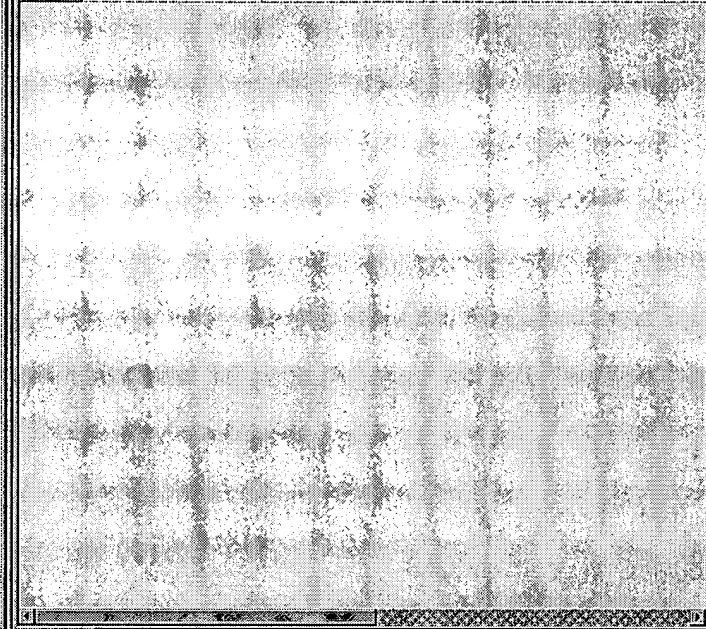
Magnetic tunnel junction random access memory architecture in which an array of memory cells is arranged in rows and columns and each memory cell includes a magnetic tunnel junction and a control transistor connected in parallel. A control line is accessed to the gate of each control transistor in a row of control transistors and a metal programming line extending adjacent to each magnetic tunnel junction is connected to the control line in spaced apart intervals by vias. Patches, groups of memory cells in each column are connected in series to form local bit lines which are connected in parallel to global bit lines. The series-parallel configuration is read using a centrally located column to provide a reference signal and data from columns on each side of the reference column is compared to the reference signal or two columns in proximity are differentially compared.

23 Claims, 9 Drawing Sheets

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2	US 20030007598		US-PGPU	20030109	78
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# (12) United States Patent Hidaka

(13) Patent No.: US 6,683,807 B2  
(14) Date of Patent: Jan. 27, 2004

(54) THIN FILM MAGNETIC MEMORY DEVICE FOR PROGRAMMING ERASABLE INFORMATION WITH AN ELEMENT SIMILAR TO A MEMORY CELL AND INFORMATION PROGRAMMING METHOD

(57) Inventor: Hidaka Etsuko, Hyogo (JP)  
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(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(d) by 0 days.

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(22) Filed: Sep. 3, 2003

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(52) Foreign Application Priority Data

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(51) Int. Cl. G11C 11/14

(52) U.S. Cl. 365/161; 365/132; 365/243.1

(53) Field of Search 365/74, 97, 99, 230, 231, 343

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(74) Attorney, Agent, or Firm—McDonnell, Will & Emery

(57) ABSTRACT

A program unit includes two program cells having an electric resistance varying according to a magnetization direction. These program cells are magnetized in the same direction in initial state, but in non-program state. In program state, the magnetization direction of one of the program cells is reversed according to program data is changed from the initial state. One-to program data and information of whether the program unit stores program data or not can be read based on two program signals generated according to the electric resistance of the two program cells.

19 Claims, 24 Drawing Sheets

